2016 Hour of Code with Tickle
Parrot Wonder

Overview

Let's put on a wondrous fly show with Parrot drone, shall we? Use Tickle app to show some fancy moves: take off, flip over, and finally a perfect landing. Design a route with coding blocks on Tickle app, have your Parrot drone ready, and enjoy a smooth fly by coding and tilting your device!

With Tickle, a user-friendly coding app, you can easily program Parrot Drone to swim in a number of ways by simply dragging and dropping coding blocks to create a command for it to follow.

Lessons

Lesson 1: Intro to Flying

Overview
•   Program a drone to take off, flip multiple times, and land.

Objectives
•   Become familiar with visual programming.
•   Program a drone to fly using basic motion commands.
•   Learn the coding concept "loop": a control statement for specifying iteration which allows code to be run repeatedly.

Steps

1. Create a Drone Project
•   Create a new drone project by tapping `+ New Project` via "MY PROJECTS". Choose the template that matches the model of your Parrot drone. Here we use the Parrot Airborne Night as an example.
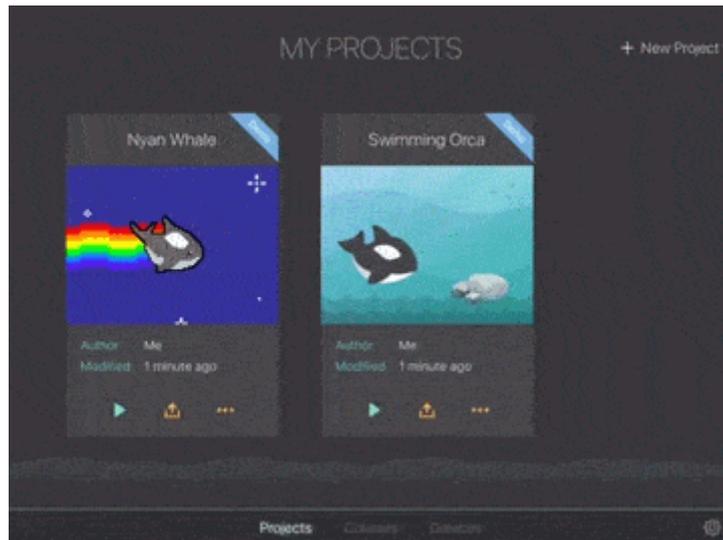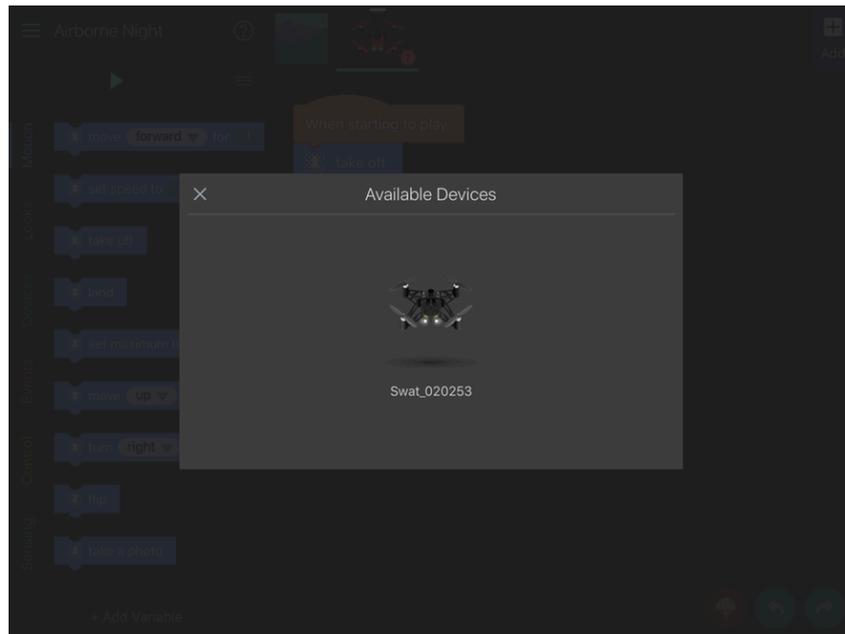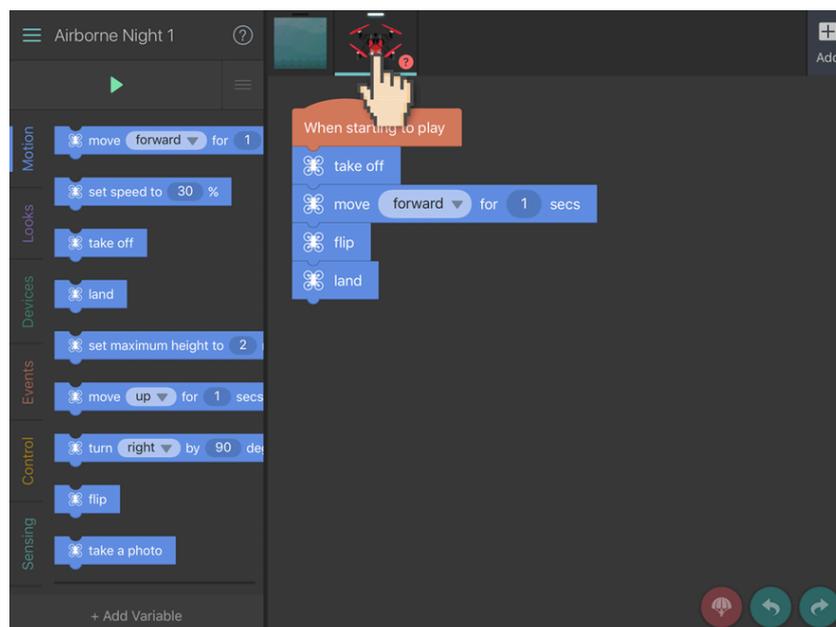
2. Connect to the Drone
- Power on the drone, and wait until its eyes are steady green (about 30 seconds).


- Your drone should automatically be detected and shown in the "Available Devices" dialog. Tap on it to connect.
  - Note: Swipe left/right if you have multiple drones.

▫ **Tip**: If your drone is powered on but not automatically detected, tap on the drone icon to show all available devices and for more tips on troubleshooting.

• The drone will show a battery status icon if it's successfully connected. Please charge the drone whenever the battery status becomes red, because the drone may stop responding to your commands.
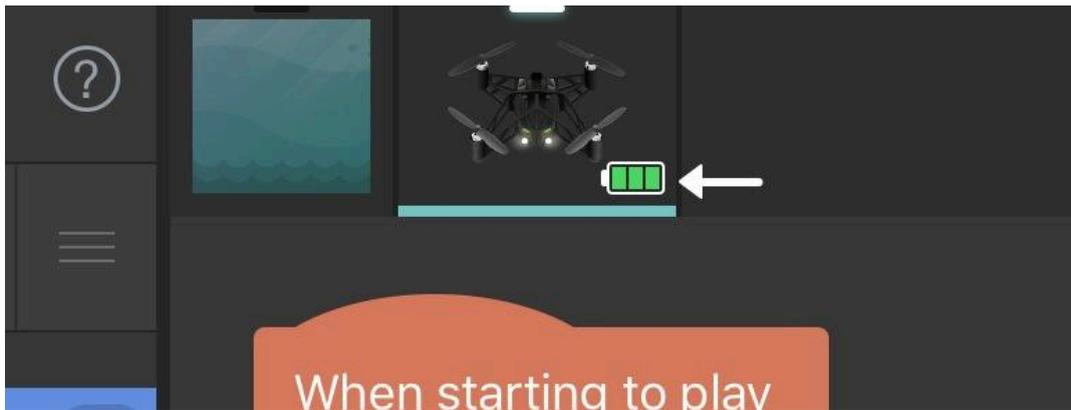
3. Let's Fly

1) Let's review blocks in the new-created document before we start to fly.

a) When starting to play :the blocks attached to this block start to execute after tapping the `Play` button of Tickle.

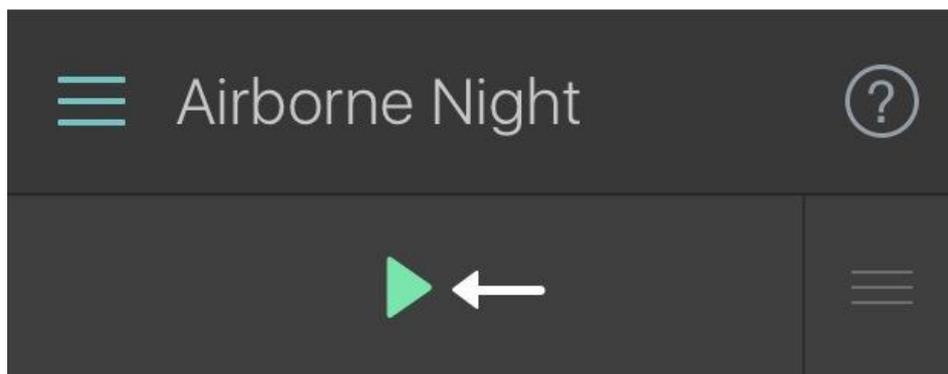b) take off : make the drone take off, which takes about 4 seconds to complete.

c) flip : flip forward.

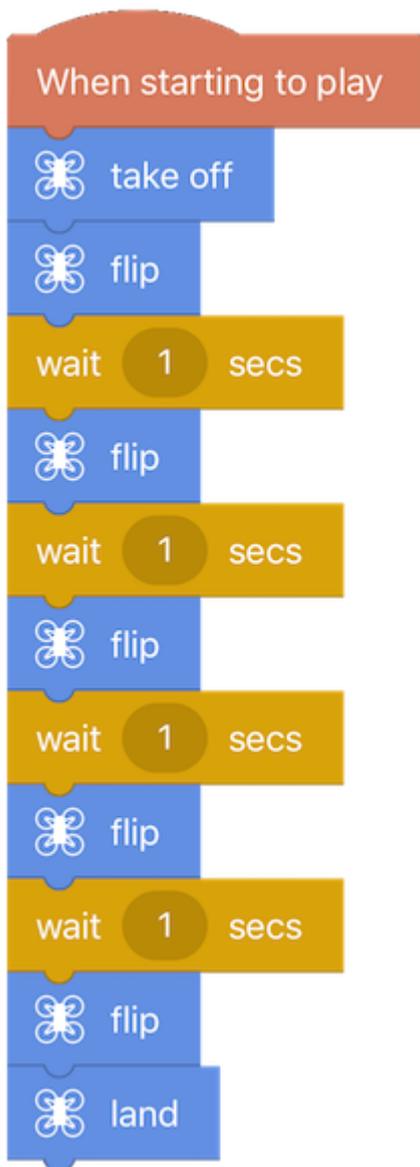d) land : land the drone.

2) Please make sure there are at least **2 meters** of open space around the drone

3) Press the green Play button to start flying.

4. Make the drone flip 5 times.

1) Let's add a total of 5 `flip` blocks.

```
When starting to play
  take off
  flip
  wait  1  secs
  flip
  wait  1  secs
  flip
  wait  1  secs
  flip
  wait  1  secs
  flip
  land
```

2) Press the green Play button to see the drone flip 5 times.
   ▫ **Tip***:* If your drone won't flip for multiple times, try adding a "Wait for 1 secs" block between each flip command.
3) Instead of using 5 `flip` blocks, try adding the block `Repeat 5 times` with a single `flip` block inside.

4) In programming, a loop is a control statement that allows code to be executed repeatedly. In Tickle, any block whose label begins with "forever" or "repeat" is a looping construct.

Lesson 2: Flying Time, Speed, and Distance

Overview

- Program a drone to fly forward at a particular speed for a specified duration to a target, then backward to the origin where it started.
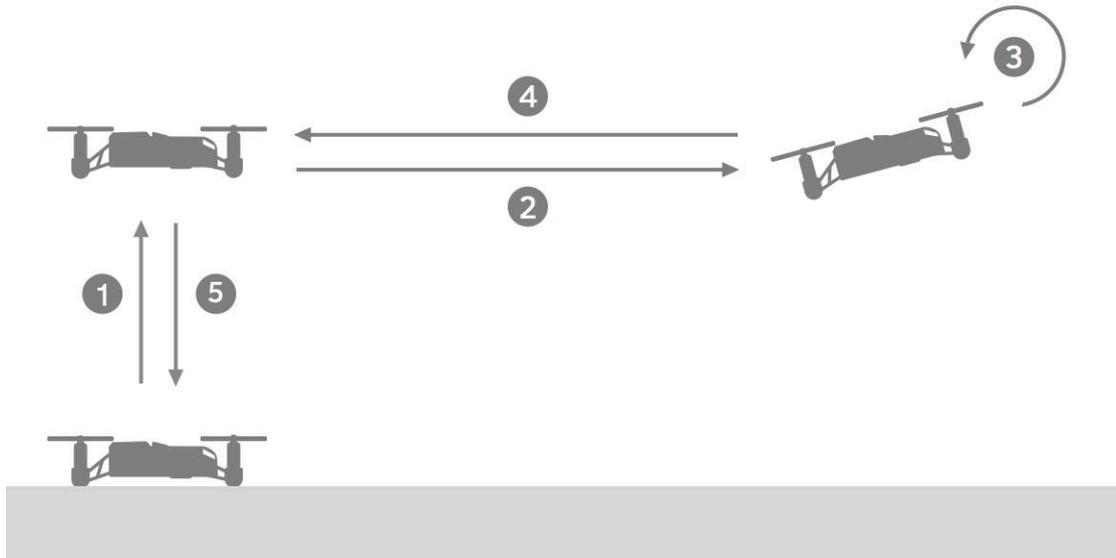
Objectives

- Program a drone to fly at different speed and duration settings, in order to fly a specific distance.
- Related Physics concepts:
    - Linear relationship between speed, time, and distance
   - Velocity is a vector describing speed value with a direction

Steps

1. Create a Drone Project

- Create a new drone project by tapping "+ New Project" via "MY PROJECTS". Choose the template that matches the model of your Parrot drone. Here we use the Parrot Airborne Night as an example
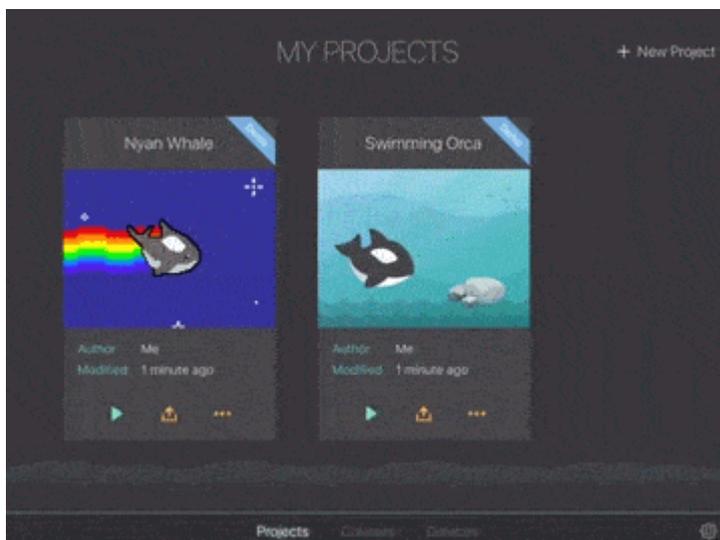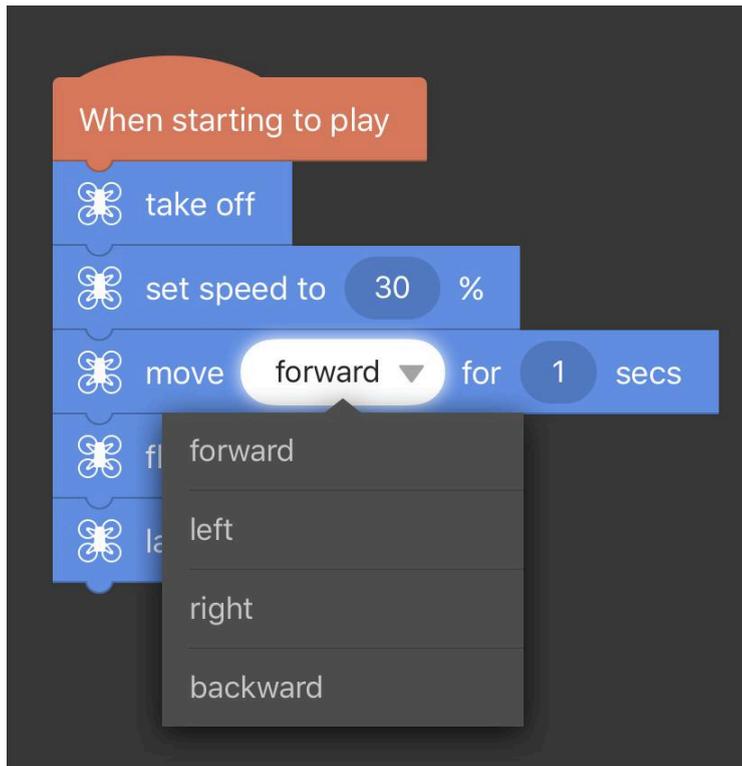
2. Fly Forward and Backward

- Use the block in the `Motion` category `Set speed to 30 %` to set the flying speed after taking off. You can change the speed by tapping on the numeric value.
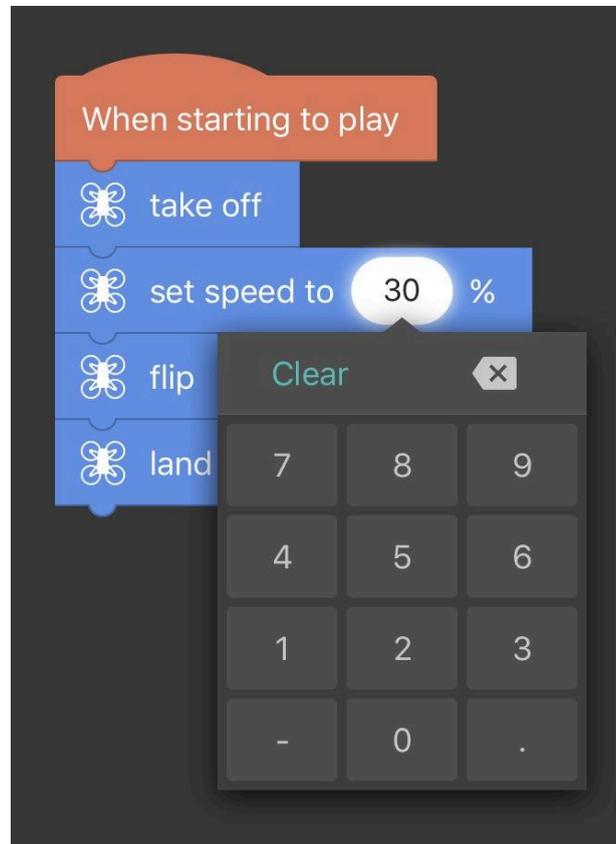
- Use the block in the `Motion` category, `move forward for 1 secs` to set the moving direction and the duration. You can choose a direction from the pull-down menu to fly forward, backward, left, and right.

- Now, let's make the drone fly forward, flip, then fly backward. The drone should return to its original starting location after executing all the commands. The program should look like the following:
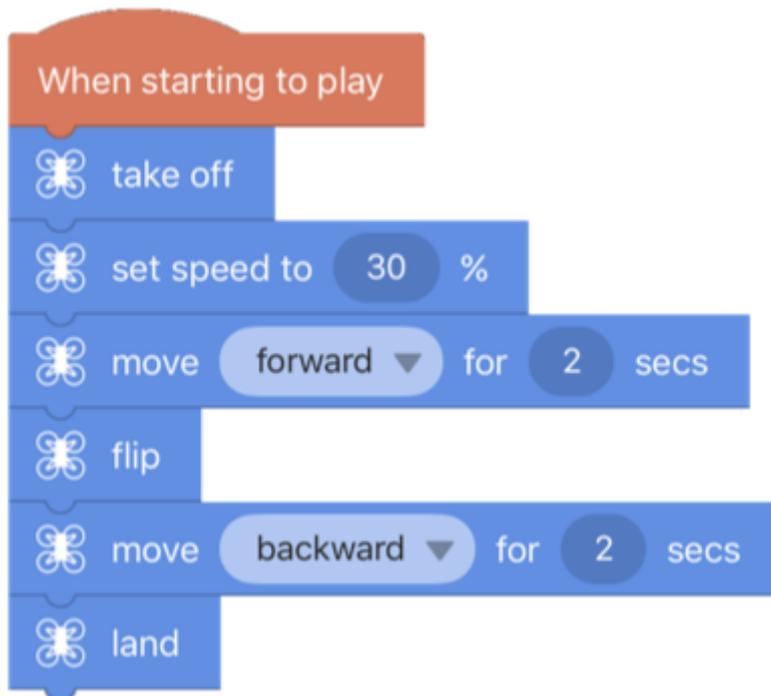
- Let's start flying by tapping the green Play button!

3. Let's do more: Relationship between Speed, Time, and Distance

- Program the Parrot drone to fly a specific distance by changing its speed and flying duration. To fly twice the distance, you can double the speed setting, for example, from 50% to 100%. Another way is keeping the speed the same, but doubling the flying time.
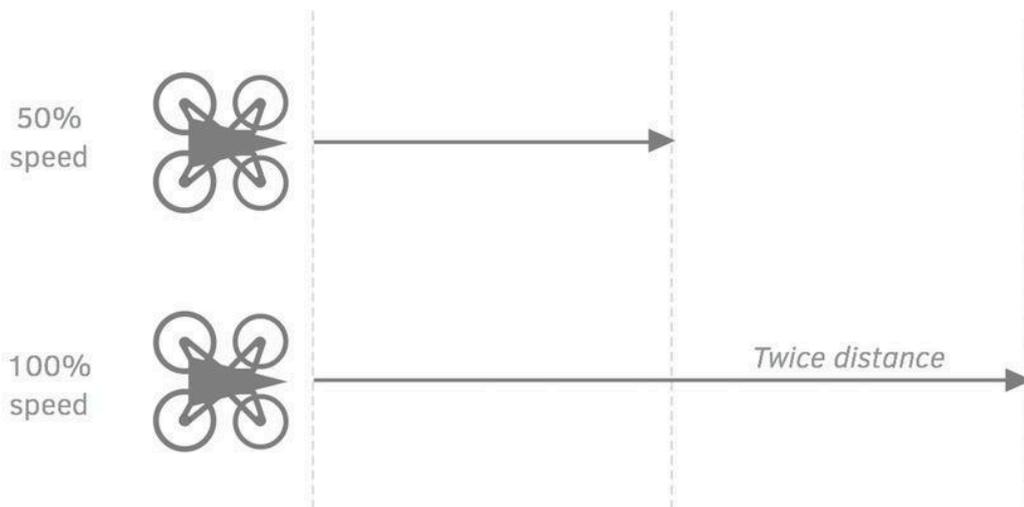
- In Physics, **distance** = **speed** x **time**. **Velocity** is a vector physical quantity; both magnitude and direction are required to define it. The scalar absolute value (magnitude) of **velocity** is called "**speed**".

4. Challenge

- Set a target landing zone and program the drone to fly and land in the that zone. Try adjusting the speed setting to 25% and 50% and see how much flying time is needed to reach the target landing zone.
- Discussion: if you want to fly to the target zone in half of the time, how should the speed setting be adjusted?

Lesson 3: Fly in a Square and Triangle

Overview

- Program a Parrot drone to fly along a square and a triangular route, by turning to specific heading angles and flying.

Objectives

- Understand heading angles (0 to 360 degrees).
- Combine turning blocks and motion blocks to turn the drone to the proper headings for flying in a square and triangle pattern.
- Use repeat loops to fly in the same pattern using fewer code blocks.
- Learn about the geometry concept "exterior angles".

Steps

1. Create a Drone Project

- Create a new drone project by tapping `+ New Project` via "MY PROJECTS". Choose the template that matches the model of your Parrot drone. Here we use the Parrot Airborne Night as an example.
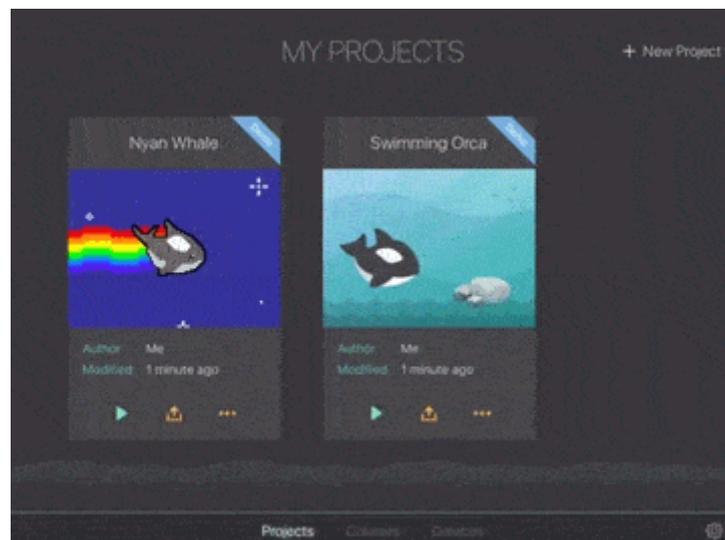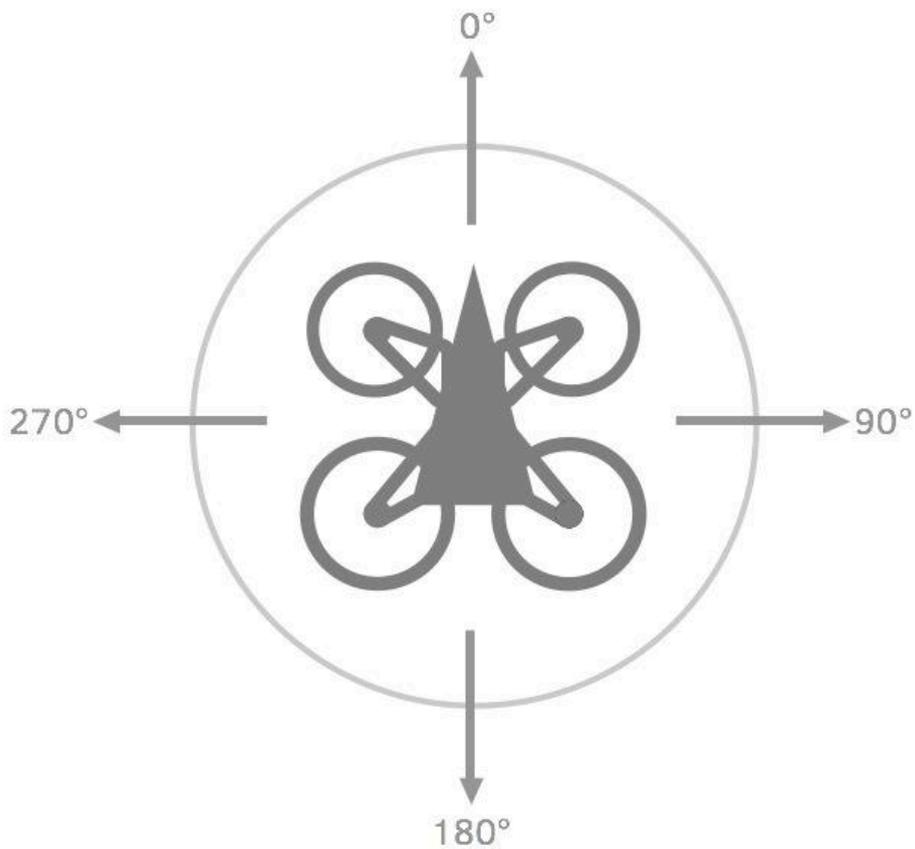

2. Turning a Complete Circle

- Heading angle is the angle that the drone is facing or pointing.
- The figure below shows heading angles at 90-degree increments. To turn a full circle, a drone has to turn its heading angle for a total of 360 degrees.
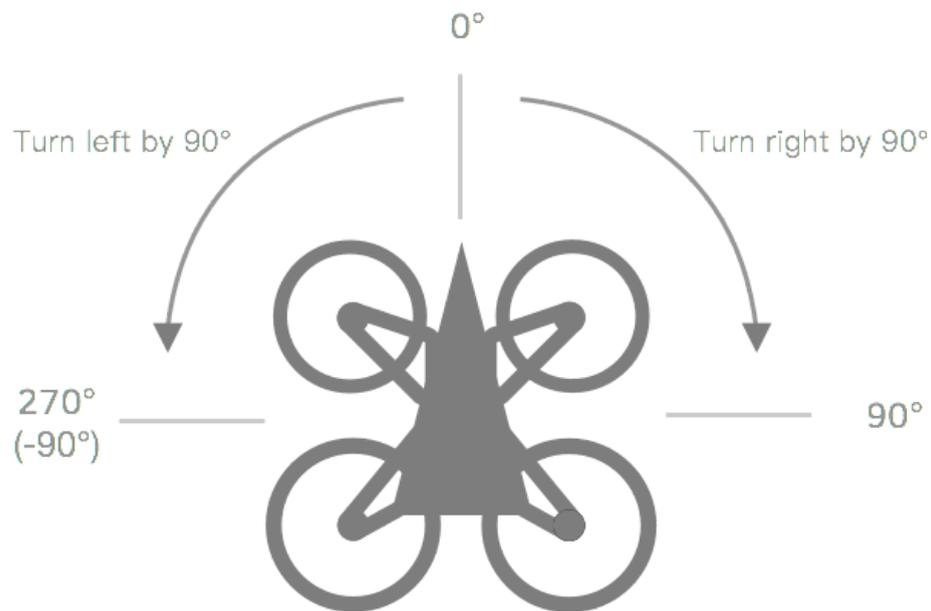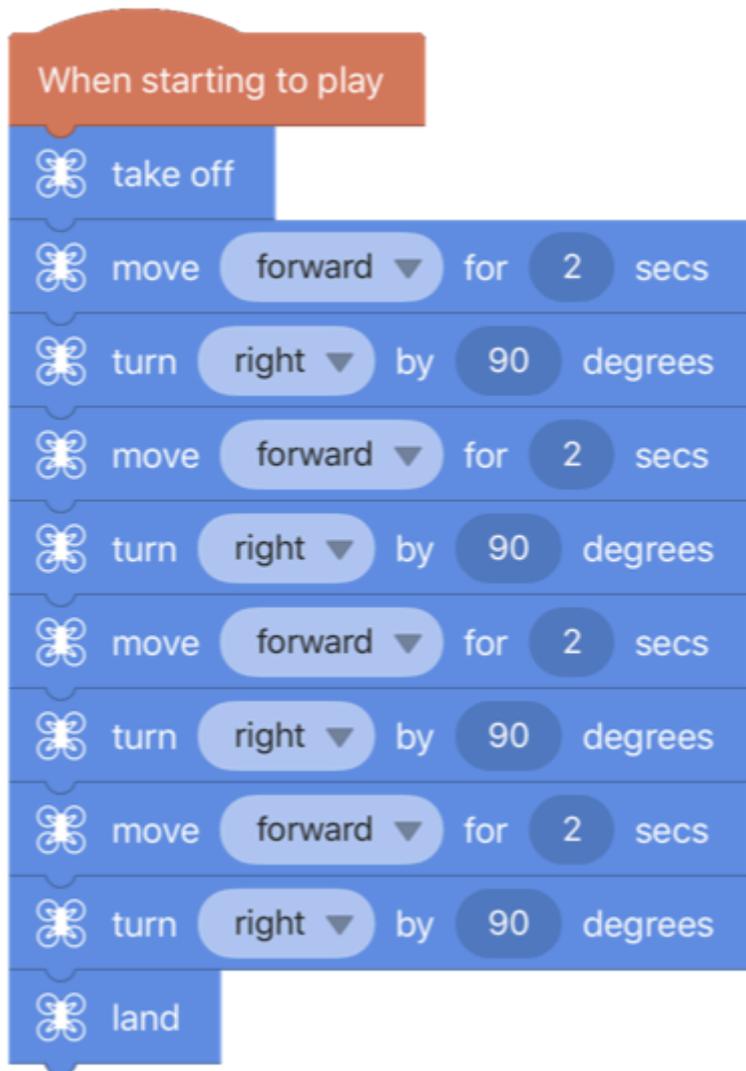
3. Fly in a Square Route

- Use the block in `Motion` category, `turn right by 90 degrees`, to turn the heading angle of the drone by a specified angle.

0°

Turn left by 90°   Turn right by 90°

270°
(-90°)   90°

- The following blocks move the drone in a square:

```
When starting to play
    take off
    move   forward ▼   for   2   secs
    turn   right ▼   by   90   degrees
    move   forward ▼   for   2   secs
    turn   right ▼   by   90   degrees
    move   forward ▼   for   2   secs
    turn   right ▼   by   90   degrees
    move   forward ▼   for   2   secs
    turn   right ▼   by   90   degrees
    land
```

4. Understanding the Components of a Square

- Notice that the drone has made a complete square by turning 4 times, turning a total of 360 degrees to return to its original heading. The degrees to turn each time is 360 degrees divided by 4, which is 90 degrees.
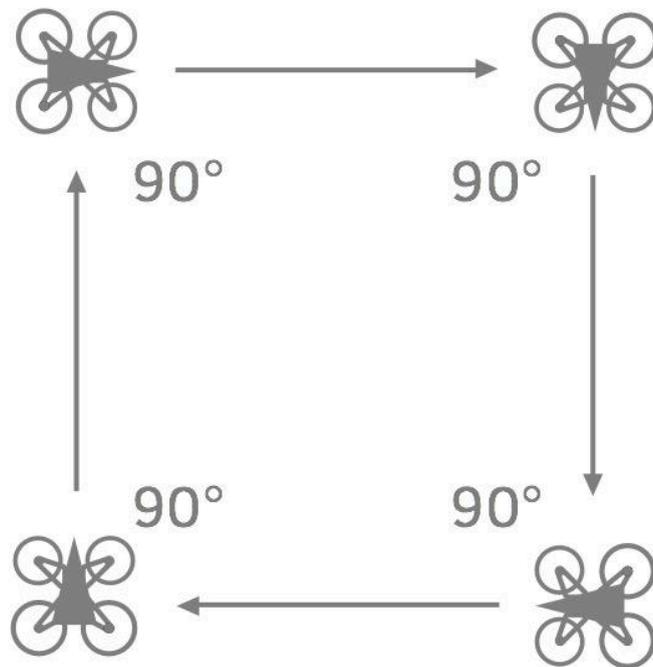
5. Fly in a Square Route using `repeat` Loops

- A `repeat n times` loop is used when the number of iterations can be calculated and known in advance. In our case for flying along a square route, the same blocks (`move forward for 2 secs` and `turn right by 90 degrees`) will be performed 4 identical times. Therefore, we can use the block `repeat 4 times` to replace the redundant blocks, and the program would look like this:

```
When starting to play
  take off
  repeat  4  times
      move  forward ▼  for  2  secs
      turn  right ▼  by  90  degrees
  land
```
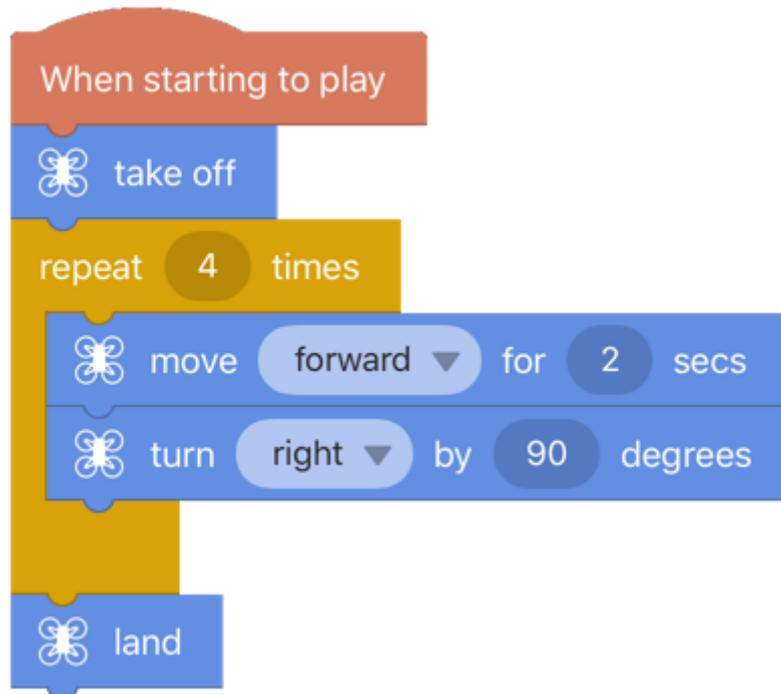
6. Program the Drone to Fly in a Triangle

- To fly in a triangle, the drone has to turn 3 times to complete a full 360° turn. The number of degrees to turn each time is then **360°** divided by **3 = 120°**.
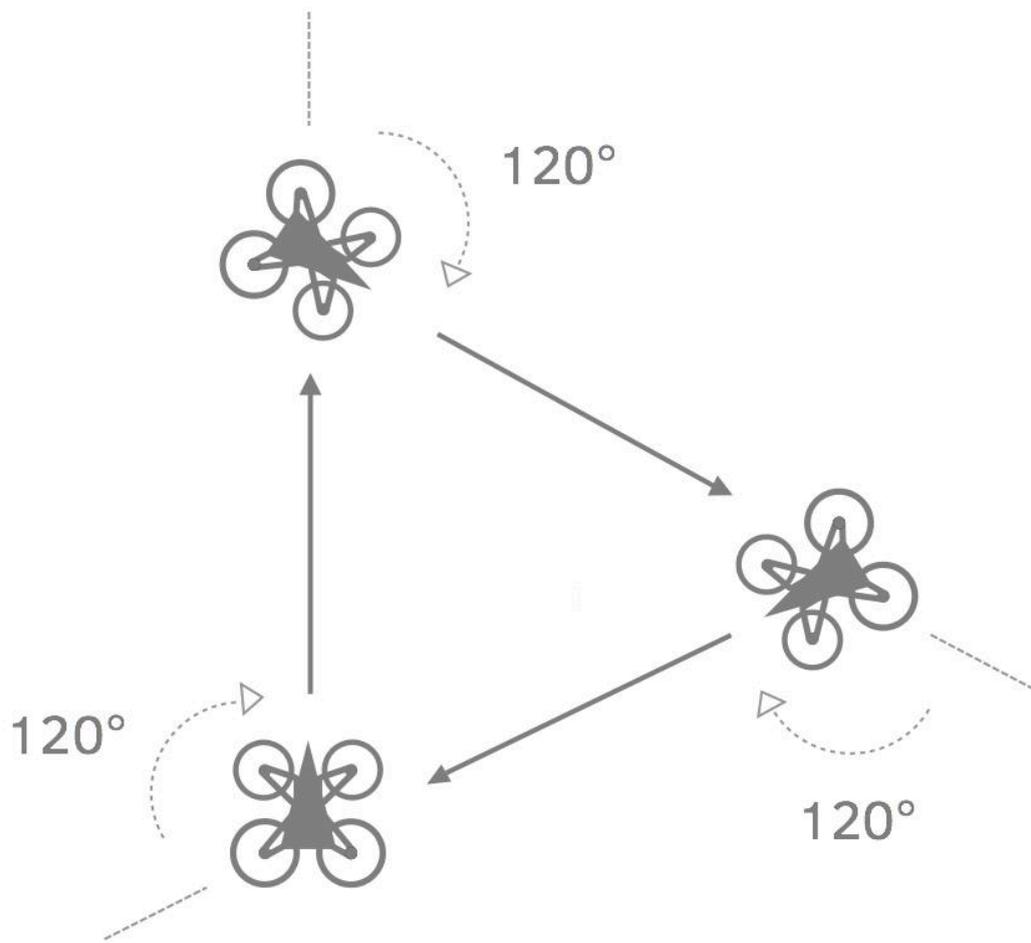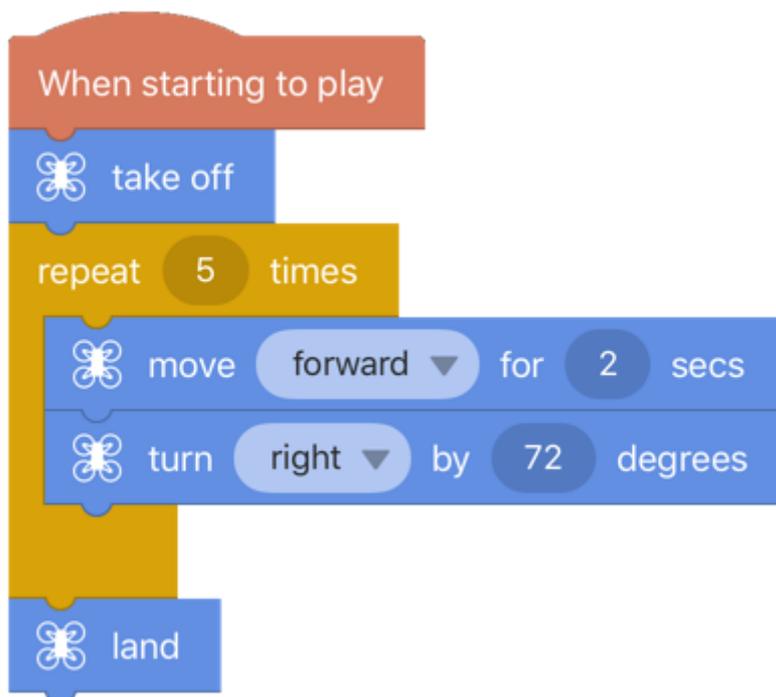
- The program should look like this:

```
When starting to play
    take off
    repeat  3  times
        move  forward ▼  for  2  secs
        turn  right ▼  by  120  degrees
    land
```

7. Challenges: Fly in a Pentagon (5 sides) and a Hexagon (6 sides)

• Calculate the degrees to turn each time by dividing 360° by the number of the sides of the geometric shape. The following in an example program for the Pentagon:

```
When starting to play
    take off
    repeat  5  times
        move  forward ▼  for  2  secs
        turn  right ▼  by  72  degrees
    land
```

- In geometry, an angle of a polygon is formed by two sides of the polygon that share an endpoint. An exterior angle (or external angle) is an angle formed by one side of a simple polygon and a line extended from an adjacent side. This is the turning angles that you've been calculating throughout this lesson.
  - The sum of all exterior angles of a polygon is 360°, and each exterior angle of a regular polygon is 360° divided by the number of sides.

Lesson 4: Pilot a Drone using Motion Sensors

Overview
- Write a program to use the motion sensors in your phone and tablet to pilot a drone. For example, program the drone to fly right when the iPad is tilted right, fly forward when tilted forward, etc. When the iPad is shaken, the drone can perform a flip in mid air!
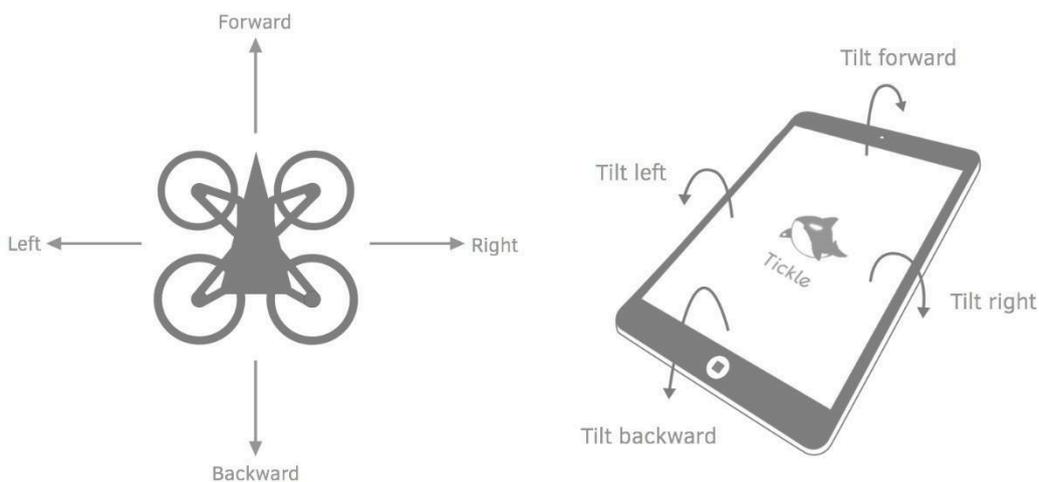
Objectives
- Use motion sensors in smartphones and tablets to sense motion events (tilt and shake) to pilot a drone.
- Understand the programming concept of "event-driven programming".

Event-driven Programming and Event Blocks
- Event-driven programming is a computer science concept in which the flow of a program is determined by events such as sensor input, user actions (like touching the screen or tilting the device), and messages from other programs.

- It is the dominant paradigm generally used in modern application like graphical user interfaces (GUI) and web-pages that performing certain actions in response to user input.
- A simple way to think of it is "**When** something happens, **do** something". For example, "When it rains, open your umbrella."

Steps

1. Create a Drone Project

- Create a new drone project by tapping `+ New Project` via "MY PROJECTS". Choose the template that matches the model of your Parrot drone. Here we use the drone Night as an example, but you can connect to any of the drones that Tickle supports.
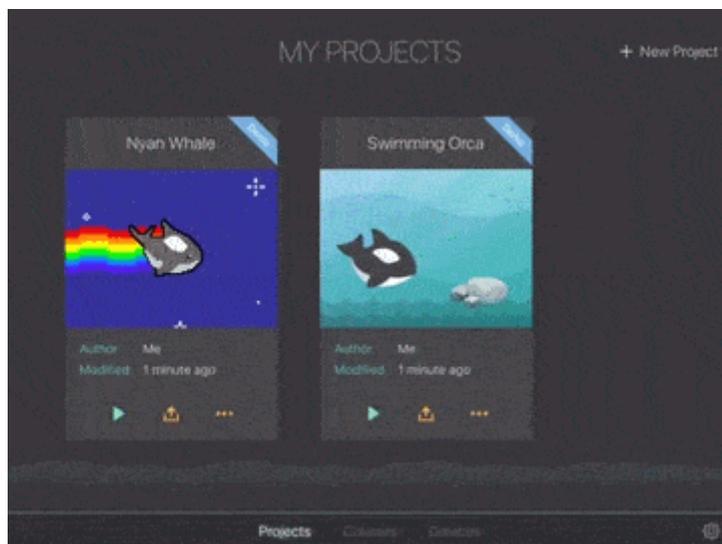
2. Fly a Drone Forward using Motion Sensors

- Under the `Events` category, add the motion sensing event block `When iPad is tilted forward` like the following:

When starting to play

🛸 take off

When iPad ▼ is tilted forward ▼

🛸 move forward ▼ for 2 secs
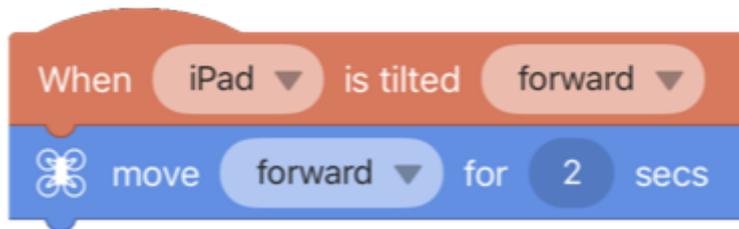
- Let's start flying by tapping the play button. You will discover that if you tilt the iPad forward, the drone will move forward for 2 seconds. Otherwise it will hover at its current position. You can land the drone by tapping the red Stop button.

3. Use Motion Sensors to Fly the Drone in Different Directions

- To pilot the drone to fly in all four directions, add a `When … tilted …` event block for each direction. Also, add a `When … Shaked …` event block to flip the drone!

When starting to play

🛸 take off

When iPad ▼ is shaken

🛸 flip

When iPad ▼ is tilted forward ▼

🛸 move forward ▼ for 2 secs

When iPad ▼ is tilted backward ▼

🛸 move backward ▼ for 2 secs

When iPad ▼ is tilted left ▼

🛸 move left ▼ for 2 secs

When iPad ▼ is tilted right ▼

🛸 move right ▼ for 2 secs